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The States Aviation Forecasting Needs

by

Julie F. Rodwell

July 1979

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16. Abstract

The purpose of this study was to evaluate the Federal Aviation Administration's (FAA) various forecasting activities, discuss where they could be altered to better meet the States' needs and review where the States' use of them could be more effective.

The report presents one state's view of some forecasting issues which arise in every state and includes recommendations, from its point of view, for future steps to be taken to resolve these issues.

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Preface

This review of the States' aviation forecasting needs was primarily prepared in December 1978 during a special assignment to the FAA Office of Aviation Policy, Aviation Forecast Branch in Washington, D.C., under the supervision of Gene S. Mercer, Chief, Aviation Forecast Branch.

I wish to thank Gene Mercer and the staffs of the Office of Aviation Policy and the Aviation Forecast Branch for their extensive guidance in this work. I also would like to thank Lowell Johnson and other staff in the Office of Airport Programs, and Tom Messier and his staff in the Office of System Plans for their help and suggestions. Since I am actively involved in the National Association of State Aviation Officials (NASAO) I also requested, and received, input from the NASAO Planning Group (a subcommittee of the NASAO Airports Committee) for which I am very grateful. This paper represents a Massachusetts view of some issues which arise in every state, though other states may see the solutions to such forecasting problems differently.

Despite all these contributions, any opinions expressed in this report are mine alone and are not necessarily shared by FAA or NASAO.

I am extremely grateful to Gene Mercer of the Aviation Forecast Branch for arranging this assignment for me, and appreciative of FAA's willingness to receive input from the State level. I hope this work will prove mutually beneficial.

Last but not least, I am most grateful to Massachusetts' Director of Aeronautics, Richard Hodgkins, for "loaning" me to FAA to undertake this assignment.

Julie F. Rodwell
Chief Planner,
Massachusetts Aeronautics Commission
January 13, 1979

THE STATES' AVIATION FORECASTING NEEDS

Summary and Recommendations

A. Introduction

State aviation agencies generally undertake forecasting as part of a state airport system plan, to help them determine where growth will occur, what kind it will be, what impacts it will have, and what facilities will be needed to accommodate it.

To a greater or lesser extent, state aviation agencies also generally monitor forecasts for their individual airports, both those done during Master Plans and those done as part of the FAA Washington (AVP-120) forecasting initiative, such as Terminal Area Forecasts and Hub Forecasts. Individual airport forecasts are needed both to analyze future facility requirements and for example for noise analysis.

State aviation agencies also try to relate to the national and regional FAA forecasts, and to other forecasts generated by the private sector, for example the airlines, and these other studies affect state policy.

B. Purpose of this Study

This study is intended to present one state aviation analyst's view on areas where FAA-supported forecasting efforts could better meet state needs. It is necessarily a personal view, and one based primarily on recent Massachusetts experience, but it is hoped that many of the questions raised have general applicability.

The post-'80 ADAP proposals now under discussion mostly call for an abolition of the current separate Planning Grant Program (PGP) which at present funds almost all Master Plan and State System Plan forecasts. This review of the states' forecasting needs may therefore serve as a first step in identifying issues the states will need to consider in setting up replacement programs under state block grants.

FAA's need for forecasts is different from the states. A major function of FAA's forecasts is for internal manpower and budgeting, particularly estimating future tower personnel requirements. Traditionally the Aviation Forecasts Branch's

work has been "top-down" analysis, providing national-level forecasts. But in order to increase their accuracy more "bottom-up" work has been undertaken in recent years, seeking to take into account local conditions.

The result of this movement towards more "bottom-up" work is that more local involvement tends to take place, and although there may not always be consensus between FAA and local aviation people--or even among different local agencies--obviously philosophically one must ask whether the national and local forecasting activities--all supported financially by FAA--could interact more closely.

In the meantime, System Plan and Master Planning forecasting activity, funded through the Planning Grant Program (PGP) continues to take place in a relatively decentralized fashion, so that it is hard for one part of the country to learn from the findings of another, and there is considerable "reinvention of the wheel" in developing forecasting methodologies.

What follows is a summary of the problems and recommendations identified during this study.

PROBLEMS

The principal problems with the current aviation forecasting process are identified as follows:

- Lack of information to the states about FAA's forecasting activities in Washington and the ways these products could be used in Master Plans and System Plans.
- Lack of information to the states about what FAA is supporting in aviation forecasts in other states and other regions.
- Duplication of effort, overlap of purpose and lack of documentation in the different levels of forecasting activity, necessitating considerable state manpower to obtain any use from many of the products.
- Lack of basic activity data at non-towered airports--some 90 percent of all public use airports and thus a major concern of the states.

- Inaccurate forecasts for individual airports under the "bottom-up" approach, which fail to mesh with state or larger geographic unit forecasts.

- Need for greater attention to capacity issues in national-level forecasts if they are to be a tool in airport facility planning.

- Inability under current regulations for states or other local agents to undertake forecasts for busy private airports.

RECOMMENDATIONS

- Further clarification to the states of FAA's role in forecasting and the purposes and availability of the various forecasting activities.

- Analysis of national events affecting aviation activity, and dissemination of findings to the states.

- Universal documentation of forecasts, and coordination with the states of forecasting efforts required for different purposes, wherever possible.

- Evaluation by FAA of state forecasting to date and publication of most useful methodologies.

- Establishment of a program for non-tower operations counts, as part of the state/FAA program recently begun for 5010 data collection.

- Publication by FAA of methodologies for individual airports based on evaluation of Master Plan methodologies to date (and new research as needed).

- Further research by FAA into capacity analysis including management techniques to increase capacity.

- Dissemination to local users of private airport forecasts undertaken by FAA for national purposes.

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THE STATES' AVIATION FORECASTING NEEDS

A. INTRODUCTION

Most State and local aviation forecasts are funded in one manner or another by Federal Aviation Administration (FAA). Not all States' forecasting needs are, however, adequately met by the present process: some forecasting procedures, particularly with regard to general aviation, are as yet far from satisfactory. Other States' needs seem if anything to be overmet - this is particularly true for the larger air carrier airports, which as a minimum are the subject of Master Plan, System Plan, Terminal Area and Hub forecasts. Nor is it clear what each level of government's responsibility should be in dealing with the various needs.

The purpose of this study is to evaluate the FAA's various current forecasting activities, discuss where they could be altered to better meet the States' needs and review where the States' use of them could be more effective. The principal intended audience is State aviation directors and planners, Department of Transportation (DOT) and Metropolitan Planning Organization (MPO), aviation and transportation planners, consultants and FAA Washington, Region and District Offices.

In 1974-1975, a study by the Transportation Systems Center (TSC) was undertaken for the FAA Aviation Forecast Branch reviewing FAA's forecasting activities. This study laid the foundation for many of the Aviation Forecast Branch's efforts in the last few years, including the Outreach Program,* the development of Hub forecasts, the gathering of better, and more, general aviation data, and the development of more flexible, policy sensitive models.

The current study is itself part of the outreach program, being one state's view of FAA's various forecasting efforts and some of its recommendations on future steps.

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*The Outreach Program is described in FAA Aviation Forecasts, FY 1979-90, as follows:

"The overall goal (of the FAA Forecasting Outreach Program) is to meld the talents and perceptions of regional, state, and local forecasters and planners, who have insight into such factors as area-specific growth patterns, with those of FAA Headquarters forecasters, who are familiar with national trends and policies. Within the context of this basic goal, the agency hopes to achieve widespread agreement on baseline socioeconomic assumptions and inclusion of all relevent input data prior to issuing forecasts for particular hubs and airports." This is being done through workshops, seminars and other local consultations and reviews.

B. PURPOSES OF FORECASTING

1. State Role

The primary role of the states in aviation is in dealing with the provision, improvement and regulation of airports. There are some exceptions, such as Texas, which also regulates intrastate carriers. There are also a number of States which do not have authority over one or more major airports - for example, Massachusetts, where the Massachusetts Port Authority runs Logan International Airport and Hanscom Field; New York, where the Port Authority of New York runs Kennedy and LaGuardia as well as several other airports, and Oregon where Portland Airport is run under a separate authority. In general, however, the States have regulatory and planning supervision of their public use airports and need to know the scale and direction of growth.

The States are very diverse in the role they play in aviation - some are very active while others are relatively passive and in the latter case, a good deal of the local decision-making on aviation matters is handled instead by the FAA Region or District office. But whether active or passive, the State's concern is with airports, and their efforts are concerned much more with

airport facilities and the noise, land use and other community issues around airports than with the airspace, which is primarily FAA's concern.

General aviation airports represent an important facet of the States' function. Unfortunately data gathering at these airports is a problem. As shown in Figure I, some 87 percent of the 6,900 airports nation-wide which are open to public use are general aviation airports; and since only 6 to 7 percent of all public use airports, and an even smaller percentage of general of general aviation (GA) airports, have air traffic control towers, there is a very little accurate knowledge about these facilities and their users. As Figure II shows, 71.3 percent of even the 3,100 NASP airports are general aviation.

Some states "channel" Airport Development Aid Program (ADAP) funds to the various eligible airports; others do not have a channelling act, and a few have a channelling act which exempts certain airports. But even in non-channelling states, the growing use of multi-year programming of ADAP funds is causing a greater and greater state role in regard to programming, technical assistance and policy guidance to individual airports.

Except for the largest hub airports, most airports do not have a planning staff and in some states the smaller airports do not even have a manager. Therefore, non-FAA expertise in

Figure I

Public Use Airports - Total

	A/C	%	Commuter	%	Reliever	%	G.A.	%	Total
Privately Owned	23*	0.3	6	0.087	26	0.38	2,649	38.3	2,704
Publicly Owned	597	8.6	127	1.84	121	1.75	3,365	48.7	4,210
Total	620	8.9	133	1.93	147	2.13	6,014	87.0	6,914

* All in Alaska

Sources: - 1978 NASP
- Office of System Plans, FAA

matters such as planning and forecasting, by default if nothing else, tend to be available only at the state level. At the airport sponsor level there is typically no capability to provide this effort in an ongoing manner, as opposed to the "one-shot" Master Plan every few years.

Given the basic premise that states are concerned mainly with the aviation system on the ground, it is clear that their forecasting needs will differ from FAA's.

2. FAA's Role

FAA needs aviation forecasts for internal manpower and budget forecasting, particularly for the 400 to 500 towered airports, and for legal purposes such as environmental impact statements. FAA's Terminal Area Forecasts are legally the forecasts used in environmental disputes. The FAA also uses forecasts of instrument approaches to plan for navigational aid installations. In apportioning ADAP funds, forecasts are not part of the process; the current law bases ADAP apportionments on estimates of population and area size for GA funds and on enplanements for air carrier funds. Discretionary monies, where anticipated rapid growth could be a reason for extra funds, are the only ADAP funds that might be allocated based on forecasts.

The FAA in its preparation of the National Airport System (NASP) needs, requires forecasts for all NASP airports. Some one-half of the total number of public use airports are in the NASP (see Figure II).

Finally, FAA in preparing national aviation forecasts includes about 5,000 of the 6,900 public use airports in the nation. This accounts for approximately 95 percent of national operations. Those airports not included are very low in activity.

Figure III illustrates the categories of public use airports in the USA and shows the approximate scale of the various forecasting efforts. States are interested in forecasts for all entities A through G.

By contrast, FAA is only interested in A through D to a small degree unless they are included in E, F or G.

Figure II

National Airport System Plan Airports

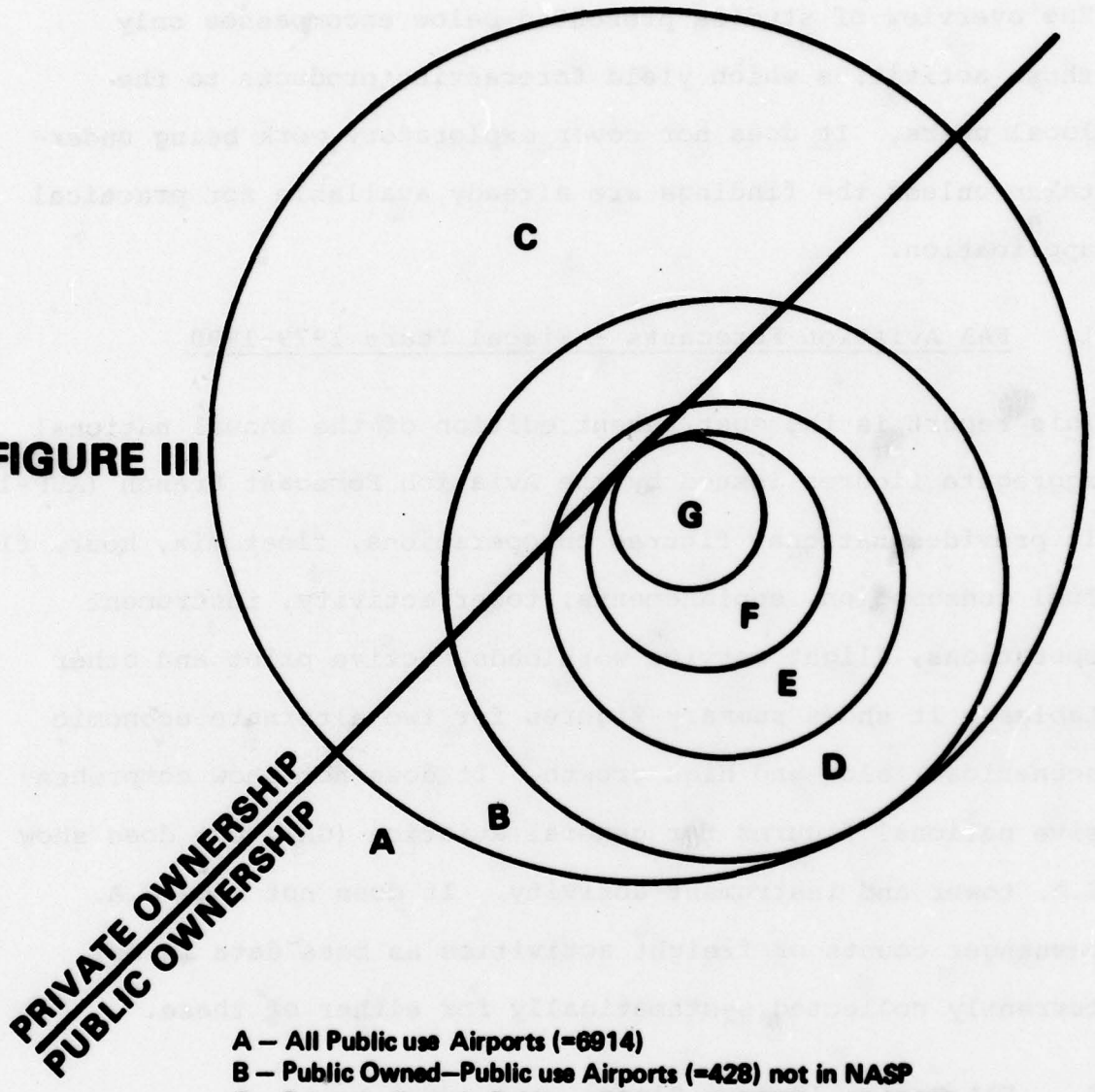
	A/C	%	Commuter	%	Reliever	%	G.A.	%	Total	%
Privately Owned	23*	.73	6	0.2	26	0.8	214	6.8	269	8.6
Publicly Owned	597	19.0	127	4.0	121	3.9	2,023	64.5	2,868	91.4
Total	620	19.7	133	4.2	147	4.7	2,237	71.3	3,137	100

*mostly in Alaska

Source: NASP
Office of System Plans
Potential Closure of Airports Report, FAA, January 1978

PRIVATE OWNERSHIP vs. PUBLIC OWNERSHIP

FIGURE III



A – All Public use Airports (=6914)
B – Public Owned–Public use Airports (=428) not in NASP
C – Privately Owned–Public use Airports (=2649) not in NASP
D – NASP Airports (3137) 91.4% Publicly Owned (Published and unpublished but in TAF computer file)
E – TAF Airports (=905) (Published only)
F – Towers = 428
G – Hubs = 25

C. AN OVERVIEW OF CURRENT FAA FORECASTING ACTIVITIES

The overview of studies presented below encompasses only those activities which yield forecasting products to the local users. It does not cover exploratory work being undertaken unless the findings are already available for practical application.

1. FAA Aviation Forecasts - Fiscal Years 1979-1990

This report is the most recent edition of the annual national aggregate figures issued by the Aviation Forecast Branch (AVP-120). It provides national figures on operations, fleet mix, hours flown, fuel consumption, enplanements, tower activity, instrument operations, flight service workloads, active pilot and other tables. It shows summary figures for two alternate economic scenarios: slow and high growth. It does not show comprehensive national figures for general aviation (GA), but does show G.A. tower and instrument activity. It does not show G.A. passenger counts or freight activities as base data is not currently collected systematically for either of these.

2. FAA Region 10-year Plans

Most Regions take the national forecasts described above and disaggregate them to obtain regional forecasts. It is not clear whether any cross-checking takes place to determine whether the sum of the Regions' forecasts equals the national.

Nor is it clear whether any standard procedure exists for the disaggregation process. However, since the Terminal Area Forecasts (TAFs) produced nationally by the Aviation Forecast Branch (and discussed below) are summed by region, there is at least some guidance for the TAF airports. The TAFs however do not reflect regional differences since disaggregation is achieved by applying one set of national forecast factors to each airport.

3. Terminal Area Forecasts

The Aviation Forecast Branch now publishes annually Terminal Area Forecasts (TAFs) for airports which either already have a tower or are candidates to get one, and/or have (or are expected to have) scheduled passenger service, and/or will have 60,000 itinerant operations or 100,000 total operations by 1980. This includes 905 airports of which 428 have towers. All these airports are National Airport System Plan (NASP) airports.

The TAF is the official FAA forecast and would be the legally accepted forecast in the case of a dispute; it is the official forecast for environmental impact statements; and the basis for FAA's internal manpower and budget planning.

The TAF provides by airport: annual current and 11 year forecasts (by fiscal year) for air carrier and air taxi/commuter enplanements; itinerant operations for air carrier, air taxi/commuter and general aviation activity; as well as local and instrument operations forecasts. It provides the current number of military operations (itinerant and local) as well as based aircraft, hours of tower operations, and whether or not there is scheduled service.

The TAF assumes there will be no additional runways, runway extensions, or other enhancements of the existing facilities at specific airports. It also assumes that an airport will be saturated when the forecast of total operations reaches twice the Practical Annual Capacity (PANCAP) as calculated using the guidelines (AC 150/5D60-1A "Airport Capacity Criteria Used in Preparing the National Airport Plan.")

For a fuller description of the assumptions and methodology underlying the TAF see pages 2-10 of the 1978 TAF report.

The TAF forecasts for not only the 905 published TAF airports, but also the other 2,232 NASP airports are now accessible via computer. As with the other FAA products which require computer terminals for access, each FAA Region will have this service and will be trained in its use. The region may change

base year data and assumptions to obtain alternative forecasts which may be retained if suitable after checking with Washington. This is known as the TAF Data System (TAFDS).

4. Hub Forecasts

In the process of preparing the TAFs it became clear that major hubs are too complex for simple annual summary statistics. The hourly patterns of scheduled carrier enplanements and operations, the traffic load of reliever and other hub area airports and the disaggregation process all needed addressing in more depth to reflect local conditions.

While the sum of the hub forecasts will equal the sum for these same airports in the TAF, under the Hub process the allocation of aviation activity growth to one hub area may be higher or lower than the national pattern. Major differences would probably cause the TAF itself to be adjusted in subsequent years. Minor differences are expected to balance out. The Hub forecasts are also consistent with the FAA's National Aviation Forecasts though there may be a time lag, e.g., the 1978 Chicago Hub forecast is consistent with the FAA report "Aviation Forecast Fiscal Years 1977-1988". Note that not all hub system airports are available in the TAF, though they are available via TAFDS.

5. General Aviation Forecasts 1975-1987

This report, done for the Aviation Forecast Branch by System Consultants, Inc., provides annual state, regional and national forecasts through 1987 of total towered plus non-towered general aviation activity in terms of total, local and itinerant aircraft operations. Unfortunately the report does not separate the tower and non-tower estimates so that a comparison with the national and the TAF is difficult.

6. General Aviation Dynamics Model (GAD)

The GAD model has been developed for the Aviation Forecast Branch by Battelle-Columbus and provides an interactive model for forecasting general aviation activity in terms of operations and hours at both towered and non-towered airports. It allows the user to change assumptions regarding cost, the national economic rate of growth and so forth. It is shortly to be made accessible to the states. Also a new contract effort is about to begin which has as its goal the production of a state or regional-level model, also interactive. There are two states, Oregon and Texas, plus one region, New England, which will be the test areas.

7. TSC G.A. Model

G.A. state forecasts for towered airports have been developed for every state by the Department of Transportation's Transportation Systems Center (TSC) for the Aviation Forecast Branch. State totals by itinerant, local, military and instrument operations are available. Since these forecasts apply only to towered airports they have more limited use. There are some discrepancies, for example instrument activity forecasts relate to both towered and non-towered airports.

8. Quarterly Forecasts

TSC has also developed quarterly forecasts for towered airports with a three-year time frame to allow better manpower planning for towers.

9. Quick-Response

The Quick-Response program developed by AVP-120 allows any user to access tower counts back to 1972 and tabulate the counts in any manner desired. It is also in the process of being developed to give short-term forecasts for each towered airport. All daily tower counts are automatically accumulated onto the file. It also provides peak day and peak hour data as collected by tower surveys for selected days.

10. Other Aviation Forecast Branch Activities

The Aviation Forecast Branch puts out many other publications each year. A request list is attached (Exhibit A).

11. Master Plans

The Airport Program, administered through the Regional FAA offices, provides Planning Grant Program (PGP) funds for Master Plan studies of individual airports. These studies include forecasts. In some cases the Master Plan will use the TAF or modified TAF; in other cases a special forecasting methodology will be developed and applied for the airport in question.

Since 1970 when the Master Planning Program began, some 1,472 Master Plans have been funded for a cost of $56m. Not all plans have developed their own forecast methodologies, but a good many have. A variety of techniques were used in the early years of the PGP, but as the TAF has been improved it has become a more useful instrument especially for small airports. If one assumes that 15 percent of all master plan funds have been expended on forecasting efforts, this means about $8.4m has been expended on forecasting methodologies for the individual airports.

EXHIBIT A

FAA OFFICE OF AVIATION POLICY AVIATION FORECAST BRANCH
SELECTED REPORTS

Please put a check mark beside publication requested, and return to FAA Aviation Forecast Branch, AVP-120; FAA; Washington, D.C. 20591.

ANNUAL REPORTS

- ☐ Aviation Forecasts, September 1978
- ☐ Terminal Area Forecasts, June 1978
- ☐ Tower Airport Statistics Handbook, Calendar Year, July 1978
- ☐ Profiles of Scheduled Air Carrier Airport Operations, November 1978
- ☐ Profiles of Scheduled Air Carrier Passenger Traffic, June 1978
- ☐ Profiles of Scheduled Air Carrier Operations by Stage Length, August 1976
- ☐ IFR Aircraft Handled, November 1977

SPECIAL STUDIES

- ☐ The Helicopter Industry - An Overview, December 1975
- ☐ Study of the Effects of Increased Cost on Corporate and Business Flying, November 1975
- ☐ A Study of Attrition in the Domestic General Aviation Fleet, April 1976
- ☐ Nationwide, Regional, and Statewide Estimates for General Aviation (GA) Activity at Nontowered Airports During CY-1972 (Revised) and FY-1974, April 1976
- ☐ Study to Develop Regional and Nationwide Estimates of General Aviation (GA) Activity at Nontowered Airports, February 1975
- ☐ Analysis of Noncapital Alternatives for Handling General Aviation Activity at Busy Airports, August 1977
- ☐ Palo Alto Airport Tower Operations, March 1977
- ☐ General Aviation: Aircraft, Owner, and Utilization Characteristics, November 1976
- ☐ Profiles of International Passengers, April 1977
- ☐ Forecasts of Commuter Airlines Activity, July 1977
- ☐ Forecasting Models For Air Freight Demand and Projection of Cargo Activity at U.S. Air Hubs, January 1977
- ☐ General Aviation Dynamics, April 1977
- ☐ FAA Aviation Forecasts Los Angeles Hub, June 1978
- ☐ FAA Aviation Forecasts Houston Hub, June 1978
- ☐ FAA Aviation Forecasts Atlanta Hub, August 1978
- ☐ FAA Aviation Forecasts Dallas/Ft. Worth Hub, November 1978
- ☐ FAA Aviation Forecasts Chicago Hub, November 1978 (Draft)
- ☐ FAA Aviation Forecasts Philadelphia Hub, January 1979 (Draft)
- ☐ FAA Aviation Forecasts Miami-Ft. Lauderdale Hub, November 1978
- ☐ General Aviation: Hours Flown and Avionics Purchase Decisions, May 1978
- ☐ Third Annual FAA Forecast Conference Proceedings, June 1978
- ☐ An Improved Forecast Model For Annual Instrument Approaches, August 1978
- ☐ Study and Forecasts of General Aviation Operations at Sixty Medium Hub Airports, March 1978

Please fill out address or attach business card.

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Title: _____

Affiliation: _____

Address: _____

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Telephone No: _____

12. System Plans

A second forecasting activity under the PGP is System Planning. Almost every state has been doing system planning since the early 1970's, and some 157 state or metropolitan system plans have been funded since that date at a total cost of $17m. In most system plans extensive custom-made work has been undertaken on the forecasting element - again, assuming 15 percent, at a cost of about $2.5m over the decade.

Summary

Some 12 different forecasting processes have been referenced here. Some overlap in geographical area and timeframe, some are mutually exclusive. The main divergences are between the locally-oriented efforts funded through the PGP, and the nationally-oriented approach of the Aviation Forecast Branch; and between forecasts that look at peak period vis-a-vis those that look at annual conditions. In recognition of the need to look at local variations the latter section of FAA began Hub forecasts and a considerable program of outreach to obtain local comments and input from the FAA regions,

State and hub airport planners and consultants. Simultaneous with these efforts, the FAA has been attempting to substantially improve the accuracy of the top-down forecasts and, therefore, for the first time, state and loca aviation planners are willing to give more credence to some of this work. The issue of how the two forecasting processes can provide greater assistance to each other will be discussed in Part E of this report.

D. PROBLEMS FROM THE STATE STANDPOINT

The principal problems identified are as follows:

1. Lack of Information About What FAA is Doing in Washington and the Ways These Products Could be Used in Master Plans and System Plans

A good deal that could be useful to the States does not filter through to them or even to the FAA Regions until it is too late. Occasionally it does not filter through at all. A recent example is FAA's study of the cost of the new Part B5 Safety Standards for Commuter Airlines, which will affect commuter forecasts.

FAA needs to be aware that only half the States have planning staff and only the major hub airports have planners. Most of these people where they are available can spend 5-10 percent of their time on forecasting issues. The average state aviation agency and the average airport do not have the professional and technical capability to undertake in-depth exploration of background materials and other forecasting studies.

A great deal of work is done in Washington which is never transmitted to the Regions, let alone to the States. Communication of new work should take place as early as possible. The Aviation Forecast Branch's workshop program

is doing some of this but it needs to be extended by mailings, and other forms of personal contact.

2. Lack of Information About What FAA is Doing in Other States and Other Regions

At the State level it is extremely hard to find out what methodologies and data services are being used successfully in other States, with the result that "reinvention of the wheel" is very common, with its implications for time and cost. This is a particularly bad problem with regard to forecasts done in Master Plans and System Plans where even Washington does not see small airport studies or their documentation and there appears to be no pooling of information from the FAA Regions.

3. Duplication of Effort, Overlap of Purpose and Lack of Documentation in the Different Levels of Forecasting Activity, Necessitating Considerable State Manpower to Obtain any Use From Many of the Products

Although there may be many cases where two different forecasts for different purposes can be justified, there are other cases where Master Plan, State System Plan and FAA

Hub or TAF forecasts seem to duplicate each other. The State planner often has the task of trying to gather documentation as a means of understanding the different models and assumptions used and interpreting the discrepancies. Often, he must act as mediator to resolve which set of numbers to accept as a basis for policy decisions.

In Massachusetts, recent experience is particularly illustrative of this situation. There are seven different forecasting activities, all paid for primarily with FAA funds, which are providing forecasts for the Boston hub area (see Figure IV).

In 1977 the current state system planning efforts got underway, with Continuous Airport System Planning Process (CASPP) funds. Through this process, a contract was undertaken with the MIT Flight Lab to do statewide and subregional forecasting. The work involves the development of a small-scale but sophisticated interactive forecasting process. This effort is costing under $50,000 for a three-year effort. During the third year the Aeronautics Commission intends to have the model put on a state computer and MIT will train a staff person in its use.

At the same time FAA has just granted the Massachusetts Port Authority about $100,000 for a forecasting effort of six months' duration to update the Logan Airport forecasts. This contract

Figure IV

Current or Planned Forecasting Activities
for Eastern Massachusetts

Work Item	Client	Undertaken By	Results Available By	Funded By
1. State level and RPA forecasts-State System Plan	Mass Aeronautics	MIT Flight Lab	December 1978	PGP-Region I FAA
2. Logan Forecasts	MassPort	Charles River Assoc.	? June 1979	PGP-Region I FAA
3. Hub Area Forecasts	FAA-Wash. AVP	FAA and Contractors	? Summer 1979	FAA-Washington
4. TAFs	FAA-Wash.	FAA and Contractors	Annually	FAA-Washington
5. New England Region Plan	ANE-1	ANE-1	Annually	ANE-1 Planning (not same as PGP office)
6. TSC Statewide	FAA-Wash.	TSC	1978	FAA-Washington
7. GAD State Model	FAA-Wash.	Battelle Columbus	1979 or 1980	FAA-Washington

will provide a second set of air carrier and other forecasts. The MIT model has already forecast Logan activity, which is 96 percent of the air carrier activity in the State. Despite the fact that Massport is a signatory to the CASPP process, with a passthrough of funds, it was not possible to persuade either Massport or the FAA Region to use the CASPP forecasts already in production - which, being policy-sensitive, could be generated for a variety of scenarios, saving the Massport planning money for other, non-duplicative activities.

At the same time the Aviation Forecast Branch will be undertaking a hub forecast for the Boston Region. The addition of the FAA hub forecast compounds the already existing forecasting problem; if decision-makers in the same sphere do not agree on what numbers to use, consistent actions are not likely to result. In the Boston case, a big question is the role of general aviation at Logan: i.e., whether what we are seeing now is the residual "hardcore" G.A. that needs to use Logan rather than satellite airports. If different forecasts show widely divergent figures for G.A. demand at Logan, it will be virtually impossible to develop a suitable policy.

Specific problems that are similar in nature have arisen for other states and may be worth referencing here. In Atlanta, the local regional planning commission is not happy with the

outcome of the TAF/Hub forecast process and there is discussion of whether to develop some PGP-funded forecasts as an alternative. The state forecasts are out of date.

In California, there was initial disagreement between the FAA and the Southern California Area Government (SCAG) over the FAA Hub forecast for Los Angeles.

In Pennsylvania, the state system plan numbers and the FAA Philadelphia Hub forecast are close, but there is still strong disagreement from the city of Philadelphia.

In Texas, the state's forecasts are higher than FAA's. Because there is a policy of attracting economic growth to the State by using airports as one of the attractors, Texas plans to build the facilities indicated by these higher forecasts, with or without Federal assistance.

Other examples abound of the Aviation Forecast Branch and Planning Grant Program forecasts overlapping and/or conflicting. The States are caught in the middle, trying to spend more and more time to get good forecasts to replace the shaky efforts at individual airports, and trying to resolve with all parties what numbers to use for decision-making, so that sound policy can emerge.

4. Lack of Basic Activity Data at Non-towered Airports

Some 90 percent of the nation's public use airports are non-tower general aviation facilities, so that there are no ongoing FAA activity counts.

Historically the source of operations data at these airports is the FAA's 5010 form, prepared through annual inspections, which was developed primarily for the purpose of keeping a current inventory of avigational hazards. Estimates of the level of activity are developed as an incidental item.

The basis of making the 5010 estimate varies widely.

In some instances it is a complete "guesstimate"; in other cases growth is estimated in proportion to growth at nearby tower airports; sometimes rules of thumb of 'x' operations per 'y' based aircraft are used; in still other cases, sample counts form the basis for 5010's. Furthermore, in some regions the 5010 figure may be developed for FAA through a non-rigorous mechanism while the state simultaneously and for its own purposes, is doing careful counts using highway traffic counting equipment (but not necessarily forwarding them to FAA).

Every forecaster knows that it is impossible to make reasonable forecasts when the base year and historical data is nonexistent or untrustworthy. In most states 85 percent or more of the airports requiring state decision-making are non-tower airports. More and more States are now contracting with FAA to gather the 5010 data but there is still no single method for collecting this data and thus comparisons between 5010 forms are often invalid.

5. Inaccurate Forecasts for Individual Airports Under the "Bottom-up" Approach Which Fail to Mesh with State Forecasts

Forecasts for individual airports are usually done under the Master Plan. Some Master Plan forecasts prove themselves wildly inaccurate after just a few years.

In most States, and nationally too, the sum of the Master Plan forecasts is 2 1/2 to 3 times higher than top-down forecasts indicate as realistic. Part of the reason for this discrepancy is the pressure by the local airport sponsor on the Master Plan consultant to boost the role of that particular airport at the expense of its neighbors with a view to obtaining a bigger slice of the construction "pie".

Another reason is the difficulty of making accurate forecasts at such a level of disaggregation. Finally, part of the difficulty is that the Master Plan seeks to look well ahead and prevent actions being taken in the short run that might preclude development options that prove to be needed in the long run. The Master Plan guidelines stress the need to look at the "ultimate development" of the airport. These guidelines were written after a decade of rapid aviation growth. The State aviation planner's problem is to reconcile these forecasts with State and national "control" totals that have been shown to be more realistic, so that a sensible statewide allocation of resources can be made.

Unfortunately, particularly for the general aviation element, this forecasting activity has not led to many sound methodologies. It is extremely difficult to forecast accurately at the micro-scale because non-linear events such as the inception of a highly aggressive, service-oriented fixed-base operator, or the arrival of a major airport-using business in a small town make individual airport forecasts suspect.

Figure V shows how in the Massachusetts Master Plans between 1972 and 1976, forecasts proved incorrect by as much as 40 percent plus or minus. Most states can show comparable problems.

Figure V

Forecast vs. Actual Activity Comparison - 1976**

Airport	Total 1976 Forecast	Interpolation	MPS Date	1976 Actual	Tower ?	Δ % Diff.
Logan	274,200	76	1975	306,655	Yes	-10.58
New Bedford	91,688	75-80	1975	85,089	Yes	7.76
	L-H av. for '77					
Hyannis	81,875	73-77	1973	96,874	Yes	-15.48
	L-H av. for '72					
Lawrence	168,386 &'77	72-77	1972	194,429	No**	-13.39
			Delayed			
Norwood	241,678	72-77	1975	204,262	Yes	18.32
Worchester	112,513	71-77	1974	76,080	Yes	47.89
	77 high forecast (per MPS)					
Beverly	164,800	72-77	1973	220,375	Yes	-25.22
Plymouth	42,500	71-77	1972	69,510	No**	-38.86
Westfield	159,800	72-77		170,127	Yes	- 6.07
Bedford	270,522	75-80	1976?	244,096	Yes	10.83
Nantucket	65,400	73-77	1973	56,386	Yes	15.99
Provincetown	19,410	72-77		24,600	No**	-21.10
Turners Falls	36,232	75-80	1976	35,023	No**	3.45
	High forecasts (per MPS)					
Taunton	69,000	72-77	1973	64,500	No**	6.98
Marshfield	71,110	72-77	1975	51,670	No**	37.62
	Low forecasts (per MPS)					
Chatham	8,560	72-77	1973	11,940	No**	-28.31
	Low forecasts (per MPS)					
Southbridge	8,300	72-77	1973	8,160	No**	1.72

Mean Δ = -.497% $\sigma\Delta$ = 23.04%
Mean $/\Delta/$ = 18.21% $\sigma/\Delta/$ = 13.38%
(σ based on N-1 weighting)

** 1976 Demand from FAA Form 5010
Underscored date in forecast interpolation indicates actual demand (base year)

***Prepared by the Massachusetts Aeronautics Commission

6. Need for Greater Attention to Capacity Issues in National Level Forecasts

For the purposes of programming facility improvements, which is one of the States' major uses of forecasts, annual aviation activity forecasting alone is not useful. It is the peak period demand/capacity and delay analyses which show where future problems are likely to lie. A shortage of capacity indicates the need for facility construction or the implementation of new facility management techniques. Thus, the States' forecasting needs are inseparable from a need for realistic capacity and delay analyses.

Forecasts done for manpower planning purposes by their nature, do not address capacity issues. Forecasts done for the NASP obviously ought to address this issue, since the NASP represents the national future airport facility requirements.

The forecasts done by the Aviation Forecast Branch do not concern themselves very much with capacity. For example the Terminal Area Forecasts (TAFs) currently use 2xPANCAP (Practical Annual Capacity) as an indicator of the "assumed saturation" of an airport. PANCAP is recognized to have weaknesses as a measure of capacity; 2xPANCAP may be either too high or too low.

FAA is producing new capacity estimation techniques that are better than PANCAP. However, even these estimates do not include a means of figuring the effect of spreading peaks that such things as bidding for slots, differential fares, differential landing fees and other "capacity management" techniques can bring about. As far as the States are concerned, forecasting as a tool for determining airport facility requirements is only useful where demand and capacity are looked at together and plans are made for the excess demand that cannot be satisfied at an individual airport. Hourly demand and capacity are much more significant than annual demand when deciding what facilities need building.

7. *Private Airport Forecasts*

Some private G.A. airports, such as the recently closed Chicagoland - (and three out of the remaining four relievers to O'Hare) - are extremely crucial to the national airport system.

There are also a number of commuter and air carrier airports which are privately owned (see Figure II). Other private airports are not so crucial but nevertheless important enough that they are included in either the national or the state airport system, or both.

Since they are private, these airports are not eligible for either ADAP or Master Plan studies. However, forecasts for some of them are included in the TAFs, the hub forecasting activities and NASP. State system plans also contain aggregate forecasts which include private airports.

E. RECOMMENDATIONS

1. Clarification of FAA's Role and Purpose in the Various Forecasting Activities

Either through the FAA Regions or through the districts a much clearer and faster communication process is required to inform users of the methods and results being developed in Washington and by the states' and airport sponsors. A quarterly newsletter including names of contact people for specific items should be prepared covering both the Forecast Branch's activities and those under the Airports Program and Planning Grant Program.

2. Analysis of National Events Affecting Aviation Activity, and Dissemination of Findings to the States

At the National level, the FAA, DOT, CAB, lobbyists and others are all actively involved in analysis of the issues of the day such as deregulation, essential air service, fuel, fleet shortages and so forth.

These events place a burden on state aviation officials to determine the likely implications for facility requirements. For instance, will regulatory reform cause the development of new scheduled service where none existed, requiring

commuter airports to be built or general aviation airports to be upgraded? Although different parts of the country react differently to these national-level changes, there is some commonality in what will probably result. Rather than 50 States each trying to assess the implications, it would be a great help if FAA in Washington produced speedy quantitative analyses of the implications of these nonlinear events and made them available to the States. Even a review of what has already happened nationwide (as opposed to predictions) in response to one of these externalities would be a considerable help to the States.

3. Documentation and Reduction of Duplication

Every Master Plan, System Plan and AVP forecast should contain clear documentation of methods and data sources, so that alternative scenarios can easily be developed and discrepancies easily understood. Documentation should always be part of the scope of work. Any forecasting at the state and local level should also include a specific work scope item for review and analysis of previous forecasts to explain discrepancies.

Given the kind of proliferation described in this paper, there is a need to compare the various forecast results, identify discrepancies, clarify the causes of these discrepancies where

possible, and if not possible, determine at any rate which set of numbers is most plausible for local decision-making. Although much more documentation is now being provided than previously, further documentation of AVP work is needed to allow this to be done. This should be reviewed with all clients to ensure that one agency is not making policy for investments based on one set of facts while another is working with something different.

The scope of work of major hub master plans should be so written as to accommodate wherever possible the requirements of the Hub Forecasting process. Wherever possible, the boundary definitions, base year and historical data, and other input should be identical. The goal should be to meld the two efforts into a single, policy-sensitive, process where both local planners and AVP use the same model with only differences in sub-routines and assumptions. In this manner the causes of discrepancies will be immediately apparent and much effort will be eliminated.

The hub forecasts should be automated and accessible in the same manner as the TAFDS, so that new data can be readily added. Eventually, since the hub forecasts have to be done annually, they could even replace forecasts done with Master Plan funds. A policy-sensitive model could take care of the needs for varied assumptions.

Ongoing monitoring is also required to see which set of forecasts turned out to be most valid. These exercises require manpower which does not generally exist at the State and local level.

Coordination between FAA agencies is obviously required. At the Regions it is needed between the general planning section and the Planning and Programs sections. Between the Regions and Washington some checks for consistency are needed. Between the Forecast Branch, the NASP office and the PGP office, coordination is needed within the Washington structure. If this coordination takes place, States will be better able to understand where to go for what, and may be able to rely more on FAA figures. Where three, four or more different sets of figures come out from FAA, they all tend to get disregarded, as no one at State level currently has the time to evaluate their various merits. State personnel are most inclined to use that forecasting work which they themselves have contracted for, where they have helped develop the scope of work and monitored progress of the forecasting activity as it proceeds.

4. Evaluation by FAA of State Forecasting to Date and Publication of the Most Useful Methodologies

State aviation forecasts seldom conform usefully to aviation market or service areas, but since the States are administrative units for aviation planning mode, State forecasts and plans will continue to be needed.

As indicated earlier, some 147 state-level forecasting efforts have been initiated as part of State System Plans. Some of these efforts have been more successful than others, but no one State knows in any systematic way which other states' methods have proven reliable.

FAA should evaluate each of the state forecasting methodologies and develop about 3-5 acceptable models which are to be made available to the States, or at least evaluate and recommend most useful elements.

Policy-sensitive, comprehensive State level models for general aviation, commuter and air carrier activity should be developed and the software made available to the States for system planning, either through time sharing or as a package for a State's own computer. This would be an extension of the GAD and TAFDS work.

Clearly the task of developing acceptable methodologies should meld the work to date of the PGP and the Aviation Forecast Branch.

The ideal product would allow a State not only to change assumptions, but also change portions of the model itself, as deemed necessary for local purposes.

5. Establishment of a Program for Non-Tower Operations Counts, as Part of the State/FAA Program Recently Began for 5010 Data Collection

What is needed in the very short run is a concerted effort to make available to the forecasters at whatever level, the best data being produced, whether under State, Airport District Office (ADO), Master Plan or FAA Regional programs: and the data provided should be documented as to method used - ideally on the 5010 sheet itself.

In the longer run, what is needed is production, marketing, and training in the use of an accurate operations counting machine. The State of Oregon, wih some help from the FAA, has developed an acoustic counter which connects to a standard cumulative counting machine with tape output. The whole package fits in a briefcase. Tests are being undertaken to determine its runway position, weatherproofing needs, battery

life and counting sample time needed to make accurate annual estimates. FAA should make this equipment and other technology of this type eligible under ADAP and/or PGP and establish a training program with the States and airport managers to use it and report the results.

Funds should be made available to purchase the equipment, train state personnel in its use, and allow state people to likewise train airport managers. This program should be fully and rapidly integrated with the ongoing program for state collection of 5010 data. A goal of replacing all 5010 operations estimates at larger G.A. airports (i.e., NASP airports) by counts within 3-5 years should be established.

6. Publication by FAA of Methodologies for Individual Airport Forecasts Based on Evaluation of Master Plan Methodologies to Date and New Research as Needed

Many Master Plan forecasts were not adequately documented and these cannot readily be evaluated. Those which remain should be sorted into forecasts which have proven reasonably accurate (say, within 3 percent per year since they were produced) and those which have not proven accurate (i.e., the rest). Account would have to be taken nationwide of factors

such as the energy crisis of 1973, which particularly affected the availability and cost of G.A. fuel. It will never be possible to evaluate every model but it should be possible to explain the relevance, magnitude, and best data sources for those factors which seem to usually explain aviation growth.

Ideally, there should also be new techniques developed and tested and made available to the States for local forecasting work. These methodologies should be interactive and flexible, or at least allow easy development of alternatives. They should be fully documented.

There is a growing consensus that for very small airports with ample capacity (for example an airport with only 20,000 operations and a capacity of 100,000) there may not be any need for forecasts since even if activity grows by 200 or 300 percent it will not necessitate new facilities. However medium and major activity airports, especially those which are growing very fast and those which have noise and land use problems, do need reasonably accurate forecasts. Although in some cases special techniques would have to be developed to reflect special local events, there are many situations when a consultant's work could be speeded up by

being able to draw on and test one or more ready-made methodologies. Based on the evaluation work recommended above and supplemented by new research, FAA should make available either full-fledged methodologies or guidelines on the elements that should be involved.

The point here is not that FAA should provide a single acceptable approach and reject forecasts done any other way, but rather, that since FAA through the Planning Grant Program had funded so many mtheodologies conservatively, at least several hundred, then the best elements of these should be extracted and communicated in ongoing fashion. Also, since the main factors that influence aviation growth are common to all regions of the country, it should be possible to build on the extensive existing work and provide the building blocks for individual airport forecasts, where it is determined that forecasts are indeed needed.

There will be many cases where a special local situation must be considered, and with interactive models these can be addressed. FAA is indeed moving in this direction, for example, making the TAF software available to Southern California to be adapted to local use. Making the TAF able to absorb new basic year data from local sources - an effort which is also underway, is also making it more useful.

7. Further Research by FAA into Capacity Analysis Including Management Techniques to Increase Capacity

Major research should continue, to quantify the capacity implications of airport and airspace management and low-capital improvement techniques, to supplement existing FAA work.

Agreement on the capacity figure or figures to be used for each airport (as well as demand figures) should take place between States, local airport sponsors and AVP Forecasting Branch so that decisions can be based on common assumptions. Through the TAFDS, updated calculations of capacity could be readily provided to AVP by the Regions.

Any airports forecast to reach these realistic capacity limits should be subject to a new process in the TAF and Hub work for distributing excess demand to other adjacent airports before finalization of these forecasts.

The focus on capacity has several implications. Firstly, it means peak hour, peak day and other "busiest time" forecasts are needed, as well as a ranking of peaks, since one does not build to accommodate the absolute peak but usually an

intermediately busy day. Forecasts must therefore show patterns of activity through the year as well as annual figures.

Secondly, the procedure for estimating capacity requires careful attention. The standard Practical Annual Capacity (PANCAP) and PHOCAP (Practical Hourly Capacity) techniques published in 1968 (AC 150/5060-1A "Airport Capacity Criteria Used in Preparing the National Airport Plan") presents a method which pertains mainly to runway acceptance capability. Procedures for figuring in airspace, terminal, apron, noise, community or other capacity constraints are not part of this methodology.

There is a need for wider use of more sophisticated procedures to estimate PANCAP and PHOCAP to account for these other factors. There may also be ways to increase annual or weekly capacity by spreading the peaks. This can be done through differential landing fees, bidding for "slots" or other fare-pricing or regulatory techniques. In addition to spreading the peaks by peak hour pricing and the like, capacity can often also be enhanced by other management techniques, many of which are low-capital or non-capital alternatives. For example, the proper spacing of turn-offs from runway to taxiway

to eliminate all taxiing on runways increases the runway capacity. The introduction of a tower may reduce time waiting to land and take off (as well as improving safety). There are many other techniques for low-capital measures to increase capacity. FAA has prepared studies on some* but they are not well known and there is as yet no method for quantitatively incorporating these considerations into capacity analysis. Research and demonstration projects by FAA could fill this void. Publicising existing efforts too would help.

For the local airport planner, demand/capacity must more closely reflect the real world. Once "true" capacity has been arrived at (assuming facility improvements which are expected) then any forecast demand which cannot be accommodated must be redistributed as follows:

- trip not made at all
- trip made by ground transportation instead
- trip made to other adjacent airport instead.

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*1) Airport Quotas and Peak Hour Pricing, Theory and Practice, May 1976, (FAA-AVP-77-5)

2) Airport Quotas and Peak Hour Pricing, Analysis of Airport Network Impacts, June 1976, (FAA-AVP-77-5)

3) Policy Analysis of the Upgraded Third Generation Air Traffic Control System, January 1977, (FAA-AVP-77-3)

4) Airports and Congestion, Ross D. Eckert, An Enterprise Institute for Public Policy Research, Washington, D.C.

Since it is the hub airports which are generally reaching capacity limits, there are implications for the pushing out from hubs to relievers of general aviation and even commuter activity to free up capacity at the hub airport, and there are also, of course, significant implications for air carrier and cargo activities. Hub forecasts must therefore reflect "true" capacity after all reasonable management and construction options have been taken into account, and any demand still unaccommodated must be reviewed as to what will likely happen, then new policies for the operation of the hub system will have to be developed.

8. Private Airport Forecasts

In areas where FAA is already doing private airport forecasts - for example, as part of a hub forecast, this material should also be specifically communicated to the state in question so that it can more easily provide technical assistance to the private airport. Although many states are barred from giving direct aid to private airports, access to federal forecasts that include them may allow the issue to be more carefully addressed at the State level.

In addition, the availability of simple interactive models for individual airports could allow States to do in-house analysis of key private airports.

The ability to do better forecasts for key private airports is not, by itself, likely to cause their survival or prevent their demise if already threatened, but it may help to indicate to the decision-makers just how vital the airport is to the system, so that greater efforts will be made toward solving the private airport's other problems.